

The Influence of Flipped Classroom Learning Strategies To Improve the Ability In Understanding Mathematics Concepts

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Received June 7, 2023

Accepted June 28, 2023

Published July 31, 2023

<https://doi.org/10.24090/ijrme.v1i1.8546>

Abstract: The ability to understand concepts is very important to understand learning material in the framework of learning outcomes that are in line with the goals to be achieved. The low understanding of students is caused by two factors, namely internal factors and external factors. Internal factors are factors inside of the students. While external factors are factors that are coming from outside of the students. The selection of learning strategies is an external factor that can increase students' understanding. Learning methods that are less innovative and boring, such as only listening to teacher explanations and lack of student activity in learning, are still teacher-centered and students often feel bored with the ongoing learning. This type of research uses an experimental method. The population in this study was class VIII at SMP Negeri 1 Baturaden. The sample of this research was class VIII A and VIII B which consisted of 66 students. The data analysis used the T-test. Conceptual understanding is an important aspect of learning that allows students to acquire in-depth and sustainable knowledge. In recent years, the Flipped classroom learning strategy has emerged as an innovative approach in education, in which learning materials are conveyed to students outside the classroom through videos or reading materials, while class time is used for discussion and application of concepts. This study aims to determine the effect of the strategy using flipped classroom.

Keywords: active interaction, conceptual understanding, education
Flipped classroom, learning strategy.

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A. Introduction

Understanding the concept is the main goal in learning which allows students to build in-depth and sustainable knowledge. However, conventional learning approaches often face obstacles in achieving in-depth understanding. Therefore, innovative learning strategies such as Flipped Classroom have been introduced as an attractive alternative. Flipped Classroom utilizes technology and the role of students in learning, where learning material is conveyed outside the classroom through videos or reading materials, while class time is used for discussion, problem solving, and application of concepts. An important factor in the teaching and learning process is understanding concepts, understanding concepts is one of the most important parts of learning mathematics, because mathematics is not only about calculating or just memorizing formulas, but also understanding the concepts of the material being studied so that you can work on problems more easily. Understanding of concepts is very related to students' interest in learning, understanding concepts is the basic goal of learning mathematics, when students understand mathematical concepts, these students will easily solve problems in mathematics. The ability to understand concepts is very important to understand learning

material in the framework of learning outcomes that are in accordance with the goals to be achieved. At present many teachers teach mathematics only by presenting material in class or we can call it a conventional learning strategy so that students are only able to solve math problems without understanding the solution to the problems given by the teacher. The low understanding of students is caused by two factors, namely internal factors and external factors. Internal factors are factors from within while external factors are factors that are outside the individual. Selection of learning strategies is an external factor that can improve student understanding. This study aims to investigate the effect of Flipped Classroom learning strategies on students' conceptual understanding abilities. In this context, we want to determine whether the application of Flipped Classroom can improve students' understanding of concepts compared to conventional learning approaches.

And the implementation of the flipped classroom learning strategy. From interviews conducted by researchers with one of the Mathematics teachers in Class VIII at SMP Negeri 1 Baturaden, namely Mrs. Yuli Puji Astuti S.Pd., one of the reasons for the low understanding is the ineffective learning strategy, which affects students' understanding to the subject matter, evidenced by the learning strategies that are usually applied by teachers at SMP Negeri 1 Baturaden in the learning process are conventional methods such as lectures, taking notes on the material provided, according to the Mathematics teacher at SMP Negeri 1 Baturaden the learning methods are less innovative and boring as only listening to explanations teachers and lack of student activity in learning, and are still centered on educators and often students feel bored with ongoing learning, therefore appropriate strategies are needed so that learning is more effective. Teachers in learning mathematics in the classroom also still lack a lot of teaching time to make students understand the material presented because the teacher has to repeat it many times so that students understand. Students do not try to work on the example questions given by the teacher, late in submitting assignments, often waiting for answers from the theme, this is what causes students at SMP Negeri 1 Baturaden to be unable to properly solve questions from the material that has been given by the teacher. The flipped classroom learning strategy is one of the learning strategies that can be used to assist students in learning which provides opportunities for students to develop their potential. During the research, the factors that influence the success of Flipped Classroom are also observed. Active interaction between students and teachers, both in the form of class discussions and collaborative activities, has been shown to be a key factor in increasing conceptual understanding. In addition, easy access to learning materials outside the classroom provides students with flexibility. The flipped classroom learning model is a learning model in which students are required to study the subject matter first at home before the material is delivered by the teacher in the classroom, so that when the learning process takes place in the classroom students only discuss issues that are not yet understood and do task The flipped classroom learning model is different from the learning model that is generally used in schools. In this flipped classroom learning model, students can repeat and re-learn at home, at school, anywhere and anytime by using electronic teaching media without having to wait for guidance from educators in understanding the material being taught.

Thus understanding the concept can help students to simplify, summarize, and classify information. By understanding the concept students can simplify, summarize, and classify information. With an understanding of the concept can also improve students' ability to

understand new information that is used to retrieve a knowledge that has been obtained. Concept understanding activities are not always carried out in the classroom, students are able to learn mathematical concepts through daily activities. The low understanding of mathematical concepts is not only caused by the lack of students' ability in mathematics, but there are other factors that can influence it. Understanding of the concept is influenced by several factors, including: internal factors (within the student), and external factors (factors from outside the student).

B. Methods

This study uses an experimental design with two groups, namely the experimental group that applies Flipped Classroom and the control group that follows a conventional learning approach. Research participants consisted of students from the same or similar classes with similar levels of conceptual understanding. Data was collected through conceptual understanding tests before and after the intervention. The research design used in the study was the Pretest and Posttest Control Group. The research was started by giving a pretest to the experimental class and control class, then giving mathematics learning to the experimental class using the flipped classroom learning model and the control class using the lecture method. After carrying out the entire learning series, the two classes were given a posttest with the aim of knowing the increase in students' understanding of mathematical concepts.

The research was conducted at SMP Negeri 1 Baturaden which is located at Jl. Raya Baturaden No. 20, Dusun II, Rempoah, kec. Baturaden, Banyuma Regency, Central Java, postal code 53126 in the even semester of the 2022/2023 school year.

Population and sample. The population is a generalization area consisting of objects/subjects that have certain quantities and characteristics determined by the researcher to be studied and then conclusions drawn. In this study, the population taken was class VIII students of SMP Negeri 1 Baturaden in the academic year 2022/2023, which consisted of 8 classes, namely classes VIII A, VIII B, VIII C, VIII D, VIII E, VIII F, VIII G, and VIII H with a total of 227 students. The sample is part of the population taken by a certain method. In this study, the samples taken were 2 classes (control class and experimental class). Population and sample.

The population is a generalization area consisting of objects/subjects that have certain quantities and characteristics determined by the researcher to be studied and then conclusions drawn. In this study, the population taken was class VIII students of SMP Negeri 1 Baturaden in the academic year 2022/2023, which consisted of 8 classes, namely classes VIII A, VIII B, VIII C, VIII D, VIII E, VIII F, VIII G, and VIII H with a total of 227 students. The sample is part of the population taken by a certain method. In this study, the samples taken were 2 classes (experimental class and control class). The researcher made class VIII A as the control class and class VIII B as the experimental class. Sampling in this study used the Convenience Sampling technique (Desire Sampling). Convenience Sampling technique is a sampling technique by selecting students because they are often easily available.

The expert validation questionnaire includes material suitability, appropriate language, and construction. This validation aims to determine the feasibility level of the instrument. There

are four response options with different scores for each. The following is the expert instrument scoring table, namely:

Table1. Expert Validation Instrument Scoring	
Average score	Description implementation
$3,25 \leq x \leq 4,00$	Very good
$2,50 \leq x < 3,25$	Good
$1,75 \leq x < 2,50$	Good Enough
$1,00 \leq x < 1,75$	Not god

The feasibility of the mathematical creative thinking ability instrument in this study is shown based on the results of the analysis that has been validated by the validator.

C. Results and Discussion

1. Data Analysis Implementation of Flipped Classroom Learning Strategies

The following will explain the result and discussion of this study:

Table 2. Data Analysis Implementation of Flipped Classroom Learning Strategies

Research Partition	Sample Location	Sum
1. Ibu Yuli S.Pd	Tuesday, May 16 2023	26
2. Azkiyah	Tuesday, May 16 2023	27
Average		3,75

Based on the table above, the results of observations made by observer 1, Mrs. Yuli Puji Astuti, was 37.1, while for observer 2, namely Azkiyah, it was 38.5. According to the table of the researcher's ability criteria, an average value of 3.75 is obtained which is at an interval of $3.25 \leq x \leq 4.00$, which means that it is in the criteria of well implemented.

2. The application of flipped classroom learning strategies to learning mathematics

In the influence data analysis, along with the explanation:

a. Experimental Class and Control Class Pretest data

The following is pre-test data obtained during the study, namely from two classes which were the object of research, namely VIII A as the control class and VIII B as the experimental class.

Table 3. Pretest value DataFor Experiment Class and Control Class

No	Eksperimen class	Pretest	Kontrol class	Pretest
1.	A1	54	B1	82
2.	A2	52	B2	82
3.	A3	67	B3	62
4.	A4	68	B4	70
5.	A5	76	B5	82
6.	A6	74	B6	54
7.	A7	56	B7	67
8.	A8	78	B8	67
9.	A9	72	B9	74

10.	A10	68	B10	57
11.	A11	72	B11	50
12.	A12	76	B12	67
13.	A13	71	B13	82
14.	A14	68	B14	80
15.	A15	72	B15	78
16.	A16	70	B16	60
17.	A17	72	B17	77
18.	A18	71	B18	58
19.	A19	68	B19	68
20.	A20	80	B20	70
21.	A21	48	B21	62
22.	A22	84	B22	72
23.	A23	64	B23	72
24.	A24	82	B24	62
25.	A25	75	B25	71
26.	A26	58	B26	48
27.	A27	62	B27	62
28.	A28	62	B28	64
29.	A29	60	B29	71
30.	A30	61	B30	72
31.	A31	-	B31	48
32.	A32	-	B32	50
33.		-	B33	62
34.		-	B34	68
35.			B35	64

The normality test is a procedure used to determine whether the data is normally distributed or not. The normality test uses the Kolmogorov Smirnov formula. The results of data analysis using SPSS Version 25 software. With the criteria if it is significant (p-value) $< \alpha = 0.05$, it means that the data is not normally distributed and vice versa if (p-value) $\geq \alpha = 0.05$, it means that the data is normally distributed. The normality test results are as follows

Table 4. Tests of Normality

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
KELAS_A	.132	30	.194	.976	30	.699
KELAS_B	.088	30	.200*	.962	30	.344

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

After the samples used in the study from both the experimental class and the control class were normally distributed data with a probability (Sig) greater than the alpha value, then the homogeneity value was sought. The homogeneity test aims to determine the variance (diversity) of data from two or more groups that are homogeneous (same) or heterogeneous (not the same). The results of data analysis using SPSS Version 25 software. With the criteria if it is significant (p-value) $< \alpha = 0.05$, it means that the data is not homogeneous or heterogeneous and vice versa if (p-value) $\geq \alpha = 0.05$, it means that the data is homogeneous. The results of homogeneity are as follows:

Table 5. Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
Based on Mean	.184	1	58	.670

hasil	Based on Median	.178	1	58	.675
pretest	Based on Median and with adjusted df	.178	1	57.985	.675
	Based on trimmed mean	.183	1	58	.670

The T test was carried out after it was known that the data taken was normally distributed. Then, to test the hypothesis in this study using an independent sample t test using SPSS Version 25 software. This hypothesis test was conducted to determine whether there is an effect of the Flipped Classroom Learning Strategy on the ability to understand mathematical concepts.

Table 6. Pretest Data T

		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
HA	Equal variances assumed	2.16	.000	-5.793	64	.000	-13.47778	2.32641	-18.12531	-8.83024
R	Equal variances not assumed			-5.411	36.277	.000	-13.47778	2.49084	-18.52810	-8.42745

Based on the results of the independent sample t test using the SPSS Version 25 software above, it can be seen that the sig. (2-tailed) $0.000 > 0.05$, then H_0 is rejected and H_1 is accepted. This shows that the scores of the experimental class and the control class are significantly different. $H_1 : \mu_1 > \mu_2$ can be interpreted that the flipped classroom learning strategy affects the ability to understand mathematical concepts in class VIII students.

b. Experimental Class and Control Class Pretest data

The following is the post-test data obtained during the study, namely from two classes which are the object of research, namely VII A as the control class and VIII B as the experimental class.

Table 7. Posttest value Data For Experiment Class and Control Class

No	Eksperimen	Posttest	Kontrol	Post-test
1.	A1	75	B1	96
2.	A2	68	B2	86
3.	A3	57	B3	72
4.	A4	78	B4	84
5.	A5	52	B5	90
6.	A6	50	B6	88
7.	A7	62	B7	84
8.	A8	88	B8	82
9.	A9	80	B9	86
10.	A10	50	B10	88
11.	A11	66	B11	82
12.	A12	61	B12	78
13.	A13	60	B13	94
14.	A14	72	B14	82
15.	A15	70	B15	86

16.	A16	74	B16	88
17.	A17	68	B17	82
18.	A18	72	B18	74
19.	A19	50	B19	78
20.	A20	90	B20	80
21.	A21	44	B21	82
22.	A22	88	B22	82
23.	A23	70	B23	80
24.	A24	86	B24	84
25.	A25	82	B25	78
26.	A26	89	B26	84
27.	A27	72	B27	82
28.	A28	74	B28	78
29.	A29	80	B29	82
30.	A30	66	B30	88
31.	A31	-	B31	82
32.	A32	-	B32	82
33.	A33	-	B33	78
34.	A34	-	B34	82
35.	A35	-	B35	90
36.	A36	-	B36	84
SUM		2094	SUM	2998
AVERAGE		69,8	AVERAGE	83,2

Based on the table above, information was obtained that the highest score in the experimental class was 96 and the lowest score was 72 with an average of 83.2, while the highest score in the control class was 90 and the lowest was 44. The following is the post-test data obtained during the study, namely from two classes which are the object of research, namely VII A as the control class and VIII B as the experimental class

Table 8. Tests of Normality

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
KELAS_A	.132	30	.194	.976	30	.699
KELAS_B	.088	30	.200*	.962	30	.344

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Based on the results of the normality test with the Kolmogorov Smirnov according to the table above, it shows that the samples used from both the experimental class and the control class are normally distributed data with a probability (Sig) greater than the alpha value. With the experimental class sig pretest value of $0.200 > 0.050$ while the control class sig pretest value was $0.088 > 0.050$.

Table 9. Independent Samples Test

Levene's Test for Equality of Variances		t-test for Equality of Means							
F	Sig.	t	df	Sig. (2- tailed)	Mean Difference	Std. Error Diffe rence	95% Confidence Interval of the Difference		
21.690	.000	-5.793	64	.000	-13.47778	2.32641	-18.12531	-8.83024	
		-5.411	36.277	.000	-13.47778	2.49084	-18.52810	-8.42745	

The T test was carried out after it was known that the data taken was normally distributed. Then, to test the hypothesis in this study using an independent sample t test using SPSS Version 25 software. This hypothesis test was conducted to determine whether there is an effect of the Flipped Classroom Learning Strategy on the ability to understand mathematical concepts.

D. Conclusion

The Flipped Classroom learning strategy was implemented in the experimental class based on the stages of the Flipped Classroom learning strategy, namely preparation, assessment and evaluation. Through this learning strategy, students can solve math problems, with the material that has been given beforehand before the learning process in class takes place, this allows students to get material beforehand so they can understand statistical material easily. Researchers hope that by implementing this learning strategy, students' understanding of mathematical concepts will further increase.

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